

**SECTION 1207****PIPE AND STRUCTURES**

Pipe and structures for storm drainage and sanitary sewers shall conform to Sections 202, 206, and 207 of the APWA Standard Specifications and these City Standard Specifications.

**1207-1 NONREINFORCED CONCRETE PIPE**

**1207-1.2 Materials.** - Delete Section 207-1.2, "Materials" of the APWA Standard Specifications and substitute the following:

Materials used in manufacturing the pipe shall be as specified in ASTM C 14, with the following exceptions:

- 1) The portland cement for sanitary sewer pipe shall be Type II modified in conformance with ASTM C 150 or Type IP (MS) in conformance with ASTM C 595.
- 2) Portland cement for drainage pipe shall be Type II in conformance with ASTM C 150 or Type IP in conformance with ASTM C 595.
- 3) All aggregates shall conform to Section 90, "Portland Cement Concrete" of these City Standard Specifications.

**1207-1.7 Perforated Pipe.** - Delete Section 207-1.7 "Perforated Pipe" of the APWA.

**1207-2 REINFORCED CONCRETE PIPE (RCP)**

**1207-2.1 General.** - Delete Section 207-2.1, "General" of the APWA Standard Specifications and substitute the following:

It shall be the Contractor's responsibility to insure the timely delivery and proper storage of all pipe materials.

All pipe sizes refer to the nominal inside diameter of pipe (including any pipe linings) and no pipe, except where specified herein, shall deviate from the nominal size designated by more than plus or minus one percent. All pipe, pipe joints incorporated into the pipe, and manufactured fittings connecting pipe between structures shall be of one and only one manufacturer's brand and of the same type, quality, class, and size unless otherwise specified or detailed on the plans. All field cut pipe shall be accomplished by methods and equipment recommended by the pipe manufacturer. No hammer and chisel cuts will be permitted.

The Contractor shall submit at his own expense, working drawings and material details of all special pipe for approval before the pipe shall be manufactured or used on the work. All pipe and fittings delivered to the job site shall be marked by the manufacturer with such inventory and identification as to be

properly identified in the field as meeting the requirements for the work.

**1207-2.1.1 Quality Assurance/Control.** - The pipe manufacturer shall designate one person for Quality Assurance. It shall be that individual's responsibility to assure pipe manufacturing Quality Control. This individual shall be responsible for all pipe testing, keeping quality control records, insuring that quality assurance procedures are followed during the manufacture of the pipe, and inspecting each pipe length before leaving the plant.

Pipe shall be separated in lots of no more than 400 feet in order of manufacture. Each pipe shall be dated according to date of manufacture and numbered sequentially for each date of manufacture, pipe class indicated for each pipe, and D-load.

- (a) **D-Load Test:** All pipe shall be subject to a D-load test at the manufacturer's plant. The Engineer may select at random and test as specified one length of each class of pipe for the D-load test as specified in ASTM C 497. Three-edge bearing test loads shall be applied to produce a 0.01-inch crack except that applied test loading may be terminated without producing a 0.01-inch maximum crack if or when such loading has reached one hundred ten percent (110%) of that required for and relative to the specified D-load for the subject pipe.

The cost of the pipe and the tests shall be borne by the Contractor. Pipe will be acceptable under the test requirements specified herein when all the test specimens conform to the test requirements. Should any of the test specimens fail to meet the test requirements, the manufacturer will be allowed to retest 2 additional specimens for each specimen that failed, and the pipe shall be acceptable only when all of the retest specimens meet the strength requirements.

Test results shall be submitted to the City prior to shipment to the project jobsite. Results shall indicate the specified D-load applied.

- (b) **Reinforcing Steel Placement:** The pipe manufacturer shall cut a minimum of four cores, at least 2-1/2 inch diameter, as indicated in the Table of Frequency of Sampling and Testing. Two cores taken near the bell end, 180 degrees apart, and two cores taken near the spigot end, 180 degrees apart, and 90 degrees from the opposite to determine the reinforcing steel location. If the steel is misplaced more than plus or minus 1/2-inch in any one core the manufacturer shall core two other sections of pipe selected by the Engineer from the lot from which the original pipe was selected. If the four cores of each pipe retested indicates the steel is in the proper location, the remainder of the pipe in that period run will be accepted. If the steel is not in the proper place that period's run will not be accepted.

All of these cores shall be checked to determine that the reinforcing steel is completely embedded in concrete and that the concrete adheres to the steel surface. The exposed surfaces of the cores shall be inspected for concrete to reinforcing steel contact. Contact between the circumferential reinforcement and the concrete shall be considered noncontinuous if a void is found in which a 1/16-inch diameter pin can be inserted 1/4-inch deep, without undue force, between the reinforcement and concrete. The lot will be acceptable if the total number of noncontinuous contact surfaces is 10% or less of the total number of steel bars exposed by the cut. If more than 10 percent noncontinuous contact surfaces are found in the first series of cores, the manufacturer may cut an additional series of cores, and if the additional cores bring the total to 10% or less, the lot will be acceptable.

If the steel location meets the specification requirements, the pipe core holes shall be filled with approved Epoxy mortar. If all other specifications requirements are met, the pipe will be accepted.

- c) Pipe Joint Shear Test: The shear load for the pipe joint shear test shall be 150 lb/in. of nominal diameter and shall be uniformly applied over an arc of not less than 120 degrees along a longitudinal distance of 12 inches. The assembled pipe shall rest on three supports. A support shall be located at each extreme end of the assembly. The third support shall be placed within 14 inches of the joint for flush bell pipe. The shear load shall be placed on a loading block (cradle) immediately adjacent to the joint. During these tests, the ends of the tested pipe shall be restrained only in the amount necessary to prevent longitudinal movement, and there shall be no joint leakage when tested either with water or air as described under "Acceptance Tests for Sanitary and Storm Drainage Systems."

Upon removal of the test load and the disassembly of the joint, neither the bell nor the spigot shall show permanent deformation or damage. If any joint tested should fail, two additional joints shall be tested. Failure of any of the additional joints so tested shall be cause for the rejection of that 400 feet of manufactured pipe.

**1207-2.1.2 Contractor Submittals.** - The Contractor shall submit the following to the Engineer:

- 1) Test Certificates or Certificate of Compliance guaranteeing that the pipe furnished hereunder is in compliance with the requirements of these City Standard Specifications.

- 2) Quality Control records of test as required by the attached "Table of Frequency of Sampling and Testing," and as specified herein.

TABLE OF FREQUENCY OF SAMPLING AND TESTING

Item Test	Frequency	Remarks
<u>At Manufacturing Plant</u>		
1. RCP Core	*	1207-2.1.1(b)
2. PVC lining ** Pull Test	1 per 50 pipe	Without regard to type of pipe or lot
3. RCP D-Load	*	ASTM C 497
4. RCP Hydrotesting, 12 PS: for 1 hr.	*	ASTM C 361
5. Absorption	1 core from item #1	ASTM C 497 Sec. 7 Method A, Max 7%
6. Concrete Strength	5 cyl 6"x 12"	ASTM C 361, Sec 10 daily Mfg cast/ independent lab test
7. Aggregate	weekly	ASTM C 33 except gradation shall not apply
8. Cert. of Type II modified cement, mix design, and gasket ASTM C-361 Sec. 9.1.2	As required	
9. PVC lining spark Flaw Test**	Each section of pipe	15,000 VAC
10. PVC lining Chemical Resistance	certification by manufacturer permitted	
11. Carbonate Equiv. Test	*	Section 12.07-2.5(5)
12. Pipe joint shear test	2 joints on first lot	
<u>In Field</u>		
13. Joint Leakage, Air hydrostatic test	each joint and each completed section	ASTM C 1103
14. PVC lining** spark Flaw Test	Each section of pipe	15,000 VAC

- \* For the purpose of these specifications, a lot is defined as 400 feet but no more than 50 sections of pipe, or fraction thereof, of one size and class manufactured on consecutive working days. If the 400 feet, but no more than 50 sections, of pipe are not made on consecutive working days, then only those made on consecutive working days shall be considered a lot. If an interruption in the manufacture of a lot occurs, the Engineer may permit the pipe made after the interruption to be included in the lot,

provided the interruption does not last more than 7 calendar days. A new lot number will be assigned if any change occurs in the size or spacing of reinforcing steel, in the concrete mix, or in the curing method.

**\*\* Lined RCP pipe only.**

3) Detailed fabrication and laying working drawings.

**1207-2.1.3 Quality Control Records.** - The Contractor shall, prior to pipe delivery, submit to the Engineer with two copy sets of the manufacturer's quality control records for pipe manufactured in accordance with this section. Records shall indicate thereon: (1) the agency and technician performing the test, (2) frequency of sampling and testing, (3) the test date, (4) the City's Job Number assigned to the project, (5) the pipe size, (6) lot number and date manufactured, and (7) required test results and additional information as required herein. Each test record sheet shall be endorsed by the manufacturer, (and the agency performing the test if other than the manufacturer), as certifying compliance with this Section.

**1207-2.2 Materials.** - Delete Section 207-2.2, "Pipe Materials " of the APWA Standard Specifications and substitute the following:

Materials shall comply with Section 6 of the appropriate ASTM Designation under which the subject pipe is to be manufactured, modified as specified hereunder.

- 1) Portland cement used in the manufacture of sanitary sewer pipe shall be Type II modified in conformance with ASTM C 150 or Type IP (MS) in conformance with ASTM C 595.
- 2) Portland cement used in the manufacture of all other pipes shall be Type II in conformance with ASTM C 150 or Type IP in conformance with ASTM C 595.
- 3) No admixtures shall be introduced to concrete mixes without specific approval by the Engineer. Approval for admixture or blend usage for pipe for a specific project shall not be considered a general use approval for subsequent projects unless stated.
- 4) Rubber for gaskets shall be neoprene and shall comply with the requirements of ASTM C 361.

**1207-2.5 Pipe Design.** Delete Section 207-2.5 "Joints" of the APWA Standards and substitute the following: Design shall comply with Section 7 of the appropriate ASTM Designation under which the subject pipe is to be manufactured, modified as specified hereunder:

- 1) In no case shall pipe be less than that specified under ASTM C 76 provisions for Class III RCP, Wall B, unless otherwise specified.
- 2) Joint assembly design shall be reinforced concrete bell and spigot type incorporating a fully retained, single or

- double rubber gasket in accordance with ASTM C 361. Steel joint rings will not be allowed. The joint shall meet the thickness requirements of the United States Bureau of Reclamation (USBR) Type R-4 joint whether flared or flush bell pipe is supplied. Reinforcement steel shall be in each end of the pipe bell and spigot.
- 3) Manufacturer's design working drawings shall be submitted to the Engineer for approval prior to fabrication. Drawings shall indicate, at relative scale, concrete covers, reinforcement placements and joint assembly design. Submittals shall also include the design pipe size, D-load, Cement type, concrete strength and areas, and types and placements of reinforcement.
  - 4) Pipe minimum and maximum lengths, except where required otherwise, shall be in accordance with Section 3.1.2 of ASTM C 361.
  - 5) Carbonate Equivalence Test for Non PVC-Lined RCP: The method and procedure for determining the alkalinity content for the inner wall of RCP shall be as follows:
    - a) A minimum of two carbonate equivalence tests shall be run on sample pipe manufactured from concrete ingredients batched each week of manufacture for each pipe size manufactured. Additional testing on different pipe sections shall be required if the carbonate equivalence results of individual tests per pipe sample vary more than 10%.
    - b) Test samples of concrete shall be obtained from randomly selected pipe sections by drilling, using carbide concrete bits as will procure at least 5 grams of material per drilling. Sample material shall be taken at two locations on the pipe interior at least 12 inches apart longitudinally and to the depth of the steel reinforcements, surface. (For elliptically placed reinforcements, sample material shall be taken at the minor axis as marked on the pipe.)
    - c) All drilled holes shall be repaired with cement and fine aggregate as specified and used in the manufacture of the subject pipe.
    - d) Each material sample shall be tested separately as obtained from the subject pipe. Test material shall be ground or pulverized sample material, oven dried for at least four hours at a temperature of 100 degrees plus 5 degrees Celsius prior to testing.
    - e) Testing shall involve the following equipment and procedures:

- 1) Equipment - Sample weighing shall be performed with a precision balance accurate to at least the nearest 10 milligrams. Liquid measures shall be performed with precision burettes accurate to at least 2/10 of a milliliter. Meters for measuring pH shall read to at least the nearest tenth of a unit. Weighing and pH meter equipment shall have been properly calibrated for correctness.
  - 2) Test procedure - Weigh at least one gram of the test material of each sample into an appropriately sized Erlenmeyer flask and add about 100 ml of distilled water. (Place glass funnel in neck of flask to minimize spray losses). Slowly add 50 ml of Standardized 1-Normal Hydrochloric Acid per gram of test material. When effervescence has subsided, heat to boiling and boil about 1/2 minute period. Cool and add 50-100 ml distilled water. Titrate with standardized, carbonate-free, 1-normal Sodium Hydroxide solution to an end point of pH 6.8 minimum to 7.8 maximum. End point reading must be stabilized for not less than two minutes.
- f) Calculation of Carbonate Equivalence - Calculation shall be based upon the chemical reaction of equivalent weights of Calcium Carbonate,  $\text{CaCO}_3$ , and the liquid measures of specifically standardized acid and base titrating solutions, to the nearest tenth of one gram at the stabilized end point. The equivalence of the tested sample shall be expressed in a percentage as  $\text{CaCO}_3$  to the nearest tenth of one percent.
- g) Test results shall be submitted to the City prior to shipment to the project jobsite. Results shall indicate the: (1) weight of the test material, (2) actual standardized normality of the acid and titrate solutions and the test amounts used, and (3) individual sample and pipe section average equivalent  $\text{CaCO}_3$  percentage.

**1207-2.7.2 Curing Procedures.** - Delete Section 207-2.7.2 of the APWA and add the following:

Cast and spun pipe shall be cured by steam or water, or a combination of both in conformance with ASTM C 76 Section 10.2.1, 10.2.2, or 10.2.3.

**1207-2.8 Causes for Rejection.** - Rejection of pipes shall be in accordance with APWA Section 207-2.8 and these City Standard Specifications. The quality of materials, the process of manufacture and the finished pipe shall be subject to inspection and approval by the Engineer. Pipe shall be substantially free of fractures and surface roughness. The ends of the pipe shall be normal to the walls and center line of the pipe, within the limits of variation given in Sections 12.3 and 12.4 of ASTM C 76. Pipe shall be subject to rejection as described in Section 15 of ASTM C 76, and in addition to the following:

- 1) Any shattering or flaking of concrete or other conditions indicating an improper concrete mix or molding.
- 2) PVC liner with bubbles, T-lock not properly embedded in the concrete or voids behind the PVC liner.
- 3) Any exposed reinforcing steel.
- 4) Voids around the reinforcing steel.

The Engineer's decision regarding rejection of the pipe shall be final and the rejected pipe shall be immediately removed from the jobsite at no cost to the City. Rejected pipe shall be clearly and indelibly marked accordingly so as to prevent confusion with pipe delivered under subsequent shipments.

Bell and spigot repairs shall be done with epoxy mortar only and shall be limited to normal pipe dressing operation. Any other repair in this area of the pipe shall require the prior approval of the Engineer before the repair is done. Other repairs outside of the bell and spigot shall be limited to a 12-inch square in any direction at the surface of the pipe and 3/4-inch deep.

Painting with cementitious slurry without the prior approval of the Engineer is strictly prohibited and shall be cause for rejection of the pipe.

The City reserves the right to accept damaged pipe after being suitably repaired by the Contractor, at no cost to the City. Repair procedures shall be submitted by the Contractor for the Engineer's review and approval prior to performing any repair work. The Engineer's approval of any repaired pipe shall not waive the right to reject repair of any subsequent damaged pipe regardless of whether or not it is similarly damaged.

**1207-9 DUCTILE IRON PIPE (DIP).** - Delete Section 207-9 of the APWA Standard Specifications and substitute the following:

Ductile Iron Pipe shall be class 150, with compression (TYCON or equal) type joints, unless otherwise specified. Pipe shall be wrapped with an 8 mils thick polyethylene in conformance with AWWA C105 (Polywrap) for corrosion resistance.

**1207-20 PIPELINE STRUCTURES.** - Pipeline structures shall conform to the requirements of these City Standard Specifications. All manhole structures shall be watertight. Eccentric manholes will not be allowed unless permitted by the Engineer.

Concrete for sewer structures shall be Class A with Type II modified cement in conformance with ASTM C 150 or Type IP (MS) in conformance with ASTM C 595. Concrete for drainage structures shall be Class A with Type II cement in conformance with ASTM C 150 or type IP in conformance with ASTM C-595.

Manholes shall be provided with covers to prevent the intrusion of debris into the sewer pipe as soon as the manhole is constructed or as directed by the Engineer. This measure does not relieve the Contractor from his duties as to alert the public from hazardous conditions as specified in these Standard Specifications.

Manholes shall have non-rocking manhole frame and covers, as shown on Standard Detail D-10, unless otherwise noted on the plans.

Manhole brick shall conform to Section 202-1.2 of the APWA Standard Specifications.

All manholes shall be provided with concrete collars to hold the frame firmly in place.

**1207-21 MEASUREMENT AND PAYMENT.** The work of this section will not be separately measured for payment. Full compensation for the materials specified in this section shall be considered as included in the various contract unit prices paid for pipe and structures and no additional compensation will be allowed therefor.